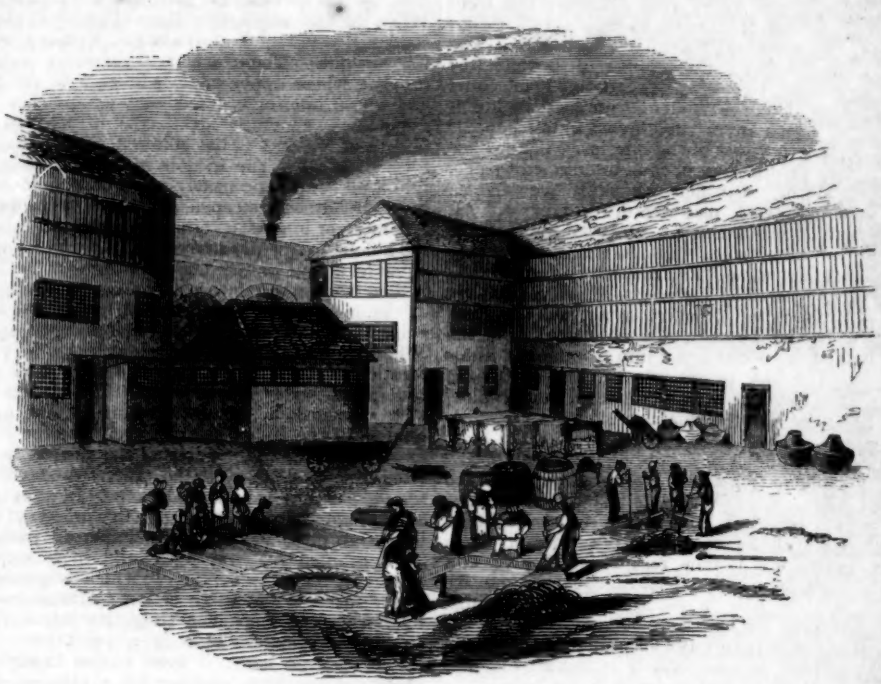
A DAY AT A LEATHER-FACTORY.



[Neckinger Mills Leather-Manufactory, Bermondsey.]

THE subject of the present article takes us to a part of the metropolis remarkably distinguished for its manufacturing features. Bermondsey has been for many years the principal seat of the leather-manufacture in England, and derives from this circumstance a character and appearance different from those presented by any other district in London. The cause to which this localization seems to be most correctly assigned, is the existence in Bermondsey of a series of tide-streams which, twice in every twenty-four hours, supply a large quantity of water for the use of the tanners and leather-dressers. The construction of Artesian wells has now in some measure diminished the employment of the water from these streams; but the streams still remain, and are still employed by many of the manufacturers.

The processes involved in the fabrication of leather, although in many respects remarkable and interesting, are very little understood beyond the circle of manufacturers and dealers. It is generally known that the avocations of the tanner, the currier, the fellmonger, the tawer, the leather-dresser, all relate in some way or other to the preparation of leather; but the relation which these employments bear one to another is not so well understood. The establishment to which our visit has been made for the purpose of this article, is connected with the production of some only of the various kinds of leather; but we hope to be able to give a general outline of the manufacture as a whole.

Leather has been designated by Dr. Ure as "the skin of animals, so modified by chemical means as to have become unalterable by the external agents which tend to decompose it in its natural state." The gelatinous portion of the skin is made to combine with chemical substances artificially applied, and by this combination the new substance, leather, is produced. The ingredients employed for the conversion of skin into leather are different in different cases, and give rise to various subdivisions of employment in the leather-manufacture. The classification of the different kinds of leather might be made according to the animals whence the skins were obtained, or according to the thickness and quality of the skins, or according to the purposes to which the prepared leather is to be applied; but we think that the purpose of the present article will be better answered by making a classification according to the mode of manufacture; and we shall therefore speak of leather as prepared—1st, by *oak-bark;* 2nd, by *sumach;* 3rd, by *alum;* and 4th, by *oil:* these four varieties being remarkably distinguished one from another.

The leather prepared by *tanning with oak-bark* is the hide of the ox, the calf, and the horse, all of which possess sufficient firmness to be applied to the manufacture of shoes, harness, and other articles requiring great strength and durability. The skins prepared by a substance called *sumach* are principally those of the goat and the sheep; and the leather resulting from the process is *morocco leather*, for coach-linings, chair-covers, book-binding, ladies' shoes, &c.; *roan* for shoes, slippers, and common book-binding; and *skiver*, an inferior leather, for hat-linings, pocket-books, work-boxes, toys, and other cheap purposes. The skins dressed in *alum* are principally those of the kid, the sheep, the lamb, and in some instances the calf; and the leather produced is principally employed for gloves and ladies' shoes. Lastly, the skins dressed in *oil* are those of the sheep, the buck, and the doe,

and the resulting leather is that of which riding-gloves and similar articles are made, as well as the soft wash-leather, or shamoy leather, familiar to every one.

Although the processes whereby these varieties of leather are produced differ very distinctly one from another, yet the establishments wherein they are conducted present a generally similar appearance. The tan-yards and leather-manufactories of Bermondsey each present to the view of a stranger an open court or yard surrounded or partially surrounded by buildings, some of which are so constructed as to admit the access of air to every part of the interior. The surface of the court or yard is in most cases intersected by pits, or square cisterns, in which the skins are steeped during some part of the manufacturing process. All bear a general resemblance, too, in two circumstances not altogether attractive to visitors, viz., the presence of unpleasant odours, and the absence of cleanliness.

1. *Leather prepared by Tanning.*—When an ox has been slaughtered, the hide removed, and the flesh transferred to the butcher, the hide is sold to the tanner, by him to be converted into the thicker kinds of leather. The hide passes into his hands with the horns attached; and he separates these from the hide, and sells them to the comb-makers and other manufacturers of horn. The hair is also attached to the hide, but the removal of this is a more difficult operation.

When the hide is purchased by the tanner, there are little bits of flesh, &c. adhering to the inner surface; and these are removed by a process called 'fleshing.' The hide is spread out over a convex wooden bench called a 'beam,' and is then scraped with knives of a peculiar shape, by which all extraneous matters are removed, and the hide is pared down to the cutis. After this process the hair is to be removed, and this is effected in one of two ways, according to the nature of the skin. One method consists in mixing together quick-lime and water, and immersing the hide in the solution; after remaining there several days, and having the lime-water renewed occasionally, the bulbous roots of the hair have become so far loosened by the action of the lime, as to be easily pulled out. The hide is then spread out on the beam, and 'unhaired,' that is, scraped with a knife till the hair is removed. In the other method, adopted in some kinds of skins which would be injured by the action of lime, several skins or hides are placed in a close chamber, where they undergo a kind of natural fermentation, sufficient to loosen the hair from the skin.

When by either of these methods the hair has been removed, the hide is 'grained,' or scraped, and then subjected to a process whereby the pores are opened and prepared for the reception of the *tan* afterwards to be applied. In some cases this consists in steeping the hide for some days in a sour solution of rye or barley flour; in others, the bath is a very weak solution of sulphuric acid in water. The hide becomes swollen, softened, and the pores ready prepared for the reception of the tan.

The bark, the roots, and occasionally the leaves of a considerable number of plants yield, by soaking in water, an astringent solution, usually of a yellowish brown colour. This solution has a peculiar action on the living skin, corrugating and constringeing it; and when applied to dead skin, has the property of converting it into leather. These vegetable substances contain a principle called *tannin*, which is the agent concerned in converting skin into leather. Provided the tannin is obtained, it matters not much to the success of the process what substance yields it; and the tanner, therefore, employs that which is, on the whole, the most effective and the most economical.

To detail the various systems adopted by different tanners would be wholly foreign to our purpose. The process is so slow a one, and the desirability of increased speed so great, that patent after patent is taken out on the subject; and almost every tanner has some process peculiar to his own establishment. We must, therefore, be as general as possible in our few details. When the hide is properly cleaned and brought to the state called 'pelt,' it is ready to be placed in one of the tan-pits. These pits are generally rectangular cisterns, whose upper edge is level with the ground, and whose interior is lined with wood. The tanning ingredient, generally oak-bark, is steeped in the cistern of water, and the solution is then technically termed 'ooze.' The hide is in the first instance put into a pit containing nearly-spent ooze, in which hides have already been steeped, and which has consequently lost more or less of its tanning principle. In this pit the hide is frequently stirred and turned to ensure the equable action of the tan on every part. The hide is then transferred to a pit containing stronger ooze, or else is stratified with crushed bark; several hides being laid one on another, and steeped in water. Whether the hides be placed at once in prepared solution of bark, or be stratified with bark in a pit containing water, depends upon the system of tanning pursued by the manufacturer, and upon the quality of the hide; but in either case the hides are exposed to renewed portions of the tanning ingredient from time to time, until the tannin has combined intimately with the animal substance. In most tanneries several months are consumed in this process of steeping in the tan-pits; and although numerous patents have been granted for improved and more expeditious processes, the limited extent to which these are adopted seems to show that there is some advantage afforded by lengthened time, not altogether attained by the speedier processes. This is a point on which we cannot enlarge here: it must suffice to say that the object of tanning, whether by a slow or a speedy process, is to cause the tanning principle to penetrate into all the pores of the hide from surface to surface: when this is effected, the hide has become transformed into leather. When the hide is tanned, it is hung up in an airy loft, or drying-room; and during the process of drying is compressed by beating, by pressure with a steel instrument, or by being passed between rollers, which gives it a smooth and dense texture.

The stoutest hides, from bulls, buffaloes, oxen, and cows, are tanned in a way more or less resembling that above detailed, and are then used principally for the soles of boots and shoes. The time employed in tanning a hide for the soles of men's boots in general is from six to twelve months; while a still thicker quality, known as 'butts' or 'backs,' frequently consumes fifteen or eighteen months in the process. The skins of calves, seals, and the lighter kinds of horse and cow skins, are tanned to form the 'upper leathers' of boots and shoes, and are prepared in a somewhat similar, but more expeditious manner. After having been 'unhaired,' they are steeped for eight or ten days in an alkaline liquor, being at intervals taken out and scraped on both surfaces, by which the lime, oil, and gelatinous matter are forced out from between the pores, and the skin rendered soft, pliant, and fit to receive the tanning ingredient. They are then exposed to the action of tan in the tan-pits until converted into leather.

Leather intended for the upper parts of boots and shoes, for saddlers, and for coach-makers, passes into the hands of the currier after tanning, for the purpose of being softened, equalized in thickness, smoothed, blacked, &c. The currier dips the tanned skin in water to moisten it, and then softens the texture by beating it with a 'mace:' this instrument consists of a wooden handle two or three feet long, with a cubical

head at one end. He then places the skin on an inclined plane called a 'horse,' and equalizes the thickness by the aid of a broad, straight, two-handled knife, called a 'cleaner,' which is worked in such a manner as to shave off the superfluous thicknesses of the skin. After this the leather is thrown again into water, and rubbed on the grain or outer side with pumice or grit-stone; whereby the 'bloom,' a whitish matter derived from the action of the bark, is removed. The leather is then rendered flexible by being rubbed, first on one side and then on the other, with an instrument called a 'pommel,' consisting of a piece of wood fastened to the hand by a strap on one side, and having on the under surface a number of parallel grooves, which have the effect of bringing the leather to a high state of flexibility. The leather is again scraped with a broad knife, to equalize its thickness and texture. Then, according to the quality of the leather, and the purposes to which it is to be applied, it is dressed with oil, with oil and lampblack, with tallow, &c.; and is polished with rubbers of hard wood.

2. *Leather prepared with Sumach.*—We now come to those varieties of leather which will enable us to refer more particularly to the establishment selected for our visit on this occasion. The manufactory known as the Neckinger Mills in Bermondsey, owned by the Messrs. Bevington, is one in which nearly all the kinds of leather prepared with sumach, alum, or oil are manufactured. Those gentlemen have kindly allowed us to witness all the processes carried on therein, and we proceed at once to give a general idea of the place and of its arrangements.

In proceeding from Bermondsey Old Church towards the Greenwich Railway, along the Neckinger Road, we arrive at the Neckinger Mills, at a short distance westward of the railway; indeed, the latter passes through part of the ground formerly belonging to the manufactory. The term 'mills' is applied because the premises were once occupied by a company formed for the manufacture of paper from straw, and were then known as paper-mills; the water for the manufacture being supplied by the Neckinger tide-stream, which flows past the building twice a-day from the Thames. About forty years ago the spot became a leather-manufactory, but the term Neckinger Mills continues to be applied to it.

On entering the gates which form the communication from the high road to the factory, we find ourselves in the open yard represented in the frontispiece. In various parts of this yard are pits, some rectangular and some circular, used not as tan-pits for tanning skins, but as lime-pits for loosening the hair and wool. Here and there are men employed in 'drawing,' or lifting out the partially limed skins, and in transferring them from place to place. Southward of this yard is another occupied principally by lime-pits similar to the others, and by lines whereon wetted skins are hanging to dry. Around the large or principal yard are ranges of buildings employed for various purposes. In one range are extensive ware-rooms for finished leather of the morocco kind; in another the white leather is contained; over these are drying-lofts, in which the skins are hung at a certain stage in their manufacture. In another part of the premises are the vessels for tanning skins with sumach; in a third the dye-house, where the morocco leathers are dyed; in others are three or four leather-splitting machines, fulling-stocks for shamoy leather, a rotating vessel for alumed leather, and various other arrangements, of which we shall speak presently. The large quantity of water employed in the several branches of the manufacture, and the necessarily dirty processes involved, keep the greater part of the buildings in a wet and sloppy state; and the existence of several dozens of cisterns or pits in the open yards render necessary some little circumspection in the steps of a visitor: indeed this circumspection is desirable on more accounts than one, for there is a sort of 'standing order' among the workmen, that although an immersion in one of the pits is open to any one, the extrication from it is valued at half-a crown.

The most important leather prepared by tanning with sumach is the morocco leather made from goat-skins. The term 'Morocco' is probably derived from the country of that name, but we are not aware whether this species of leather was originally manufactured there. Be this as it may, the finer kinds of morocco leather, employed for coach-linings, chair-covers, &c., are prepared from goat-skins; while the inferior or 'imitation' morocco, applied to purposes wherein cheapness is desired, is made from sheep-skin. Morocco is familiarly known to most persons as a glossy coloured leather, whose surface presents a wrinkled and fibrous appearance; and we perhaps cannot better illustrate the process of preparing leather by sumach than by tracing the manufacture of this variety.

The goat-skins employed for this purpose are imported from various parts of the world—Switzerland, Germany, Memel, Mogadore in Northern Africa, the East Indies, the Cape of Good Hope, Asia Minor, and other places. The skins from some places are preferred on account of their thickness or good quality; from others on account of their size; while others are purchased according to the supply which may happen to be in the market. The skins are imported with the hair on, and to remove this is one of the first processes of the manufacture. The goat-skins are first soaked in water for several days to soften them, and then undergo the process of 'breaking,' that is, scraping them on the flesh side to remove the adherent substances which would interfere with the process of tanning. The 'fleshings' and other scraps obtained in processes similar to this are placed on open racks or stages exposed to the air, and when dry are sold to the manufacturers of glue and size; as are likewise the fleshings and other scraps from the thicker hides and skins prepared by the tanner.

Into the lime-pits before noticed a solution of lime in water is conveyed, and the goat-skins, after being fleshed, are allowed to soak therein for four or five weeks. During this time they are frequently 'drawn,'

['Drawing' Goat-skins.]

a process represented in the annexed cut, and consisting in taking the skins out of the pit, laying them in a heap on the side, allowing them to lie thus for a certain time, and immersing them again: all this has

the effect of causing the lime to act equally on every part of the hairy covering, and the lime-water is renewed once or twice, to aid in producing the desired effect.

When the liming has been carried to such an extent that the hair can be easily pulled out with the finger, the goat-skins are drawn from the pits, and conveyed in wheelbarrows to the 'fleshing-shop,' one of the buildings in the western part of the premises. In this shop are a number of 'beams,' as they are called, consisting of convex work-benches or stools sloping downwards from one end to the other, and supported on a frame or stand. Each goat-skin is laid smoothly on a 'beam,' with the hairy side uppermost; and the workman, standing at the upper end of the beam, scrapes off all the hair by means of a double-handled knife. The convex form of the surface on which the skin is laid, and the peculiar form given to the knife, enable the workman to take off all the hair very completely. The operations of 'fleshing,' of 'unhairing,' and of 'graining,' are so nearly alike in

[Unhairing a Goat-skin.]

their general appearance, that the annexed cut will sufficiently show the character of the whole; the principal difference being in the edge of the knife employed by the workman. The hair which is thus removed from the goat-skins is, after being cleansed, sold to the carpet-manufacturers and to plasterers.

After the process of 'unhairing,' the goat-skins are again soaked in lime-water for two or three days, and are then again 'fleshed,' or scraped on the inner surface, by which the cutis is brought to a tolerably clean state. But the long steeping which the skin has undergone has had the effect of driving the lime into the pores, insomuch that the tanning principle contained in the sumach, afterwards to be applied, cannot reach the heart of the skin. The tanning, therefore, cannot be commenced until the lime is removed and the pores opened. The means adopted for effecting this are by far the most disagreeable in the whole range of the manufacture. A solution called the 'pure' or the 'pewer' (having never seen the word written or printed, we must spell it as pronounced), is prepared in a large vessel, and into this the skins are immersed: there is an alkaline quality in the solution employed, which has the effect of removing the lime from the pores, and the manufacturers seem to have failed hitherto in finding more than one substance which yields this quality effectually. Whether chemistry may hereafter afford them a more extensive range it is not for us to say, but such would seem to be at least probable. After being 'pured' for some time, the skins are taken out and scraped well on both sides, for the sake of removing as much of the lime and the albumen as may be removable by these means; and after this they are steeped again.

By these operations the pores of the goat-skin are so far opened and cleared as to prepare them for the reception of the tanning principle. The substance employed in tanning stout hides is, as we before explained, oak-bark; but for goat-skins the tanning ingredient is a vegetable substance called *sumach*. This is the powder of the leaves, peduncles, and young branches of a plant called the *Rhus coriaria*, growing in Sicily, Italy, and Hungary. It is one of the substances experimented on by Sir H. Davy in his inquiry into the tanning properties of various bodies; and he found it to contain a large proportion of tannin. It contains also a light colouring-matter, which seems to render it useful for the tanning of light-coloured leathers. It is employed extensively in dyeing, as well as in leather-dressing. In the sumach tan-houses at Messrs. Bevington's we saw a pile of this substance, just as imported from Sicily, in cloth bags containing about one cwt. each: when the bags are opened, the sumach appears as a fine yellow powder.

The manner in which this tanning ingredient is forced into the pores of the goat-skin is exceedingly curious. The sumach is mixed with water; but if the skins were immersed indiscriminately in the solution, or even laid smoothly one on another, the sumach would not act equally on the whole surface. To produce the desired equality of action, the following singular plan is adopted:—The wet goat-skins are taken from the 'pure,' or alkaline solution, and sewn up by women into bags, each skin forming a bag with the grain side outwards, and having no opening except a small one at that part which had formed the hind shank of the animal. These bags, as soon as made, are thrown into a vessel of water, and examined, to see that they are well sewn up, and free from holes. They are then taken to the sumach-tub, where the process represented in the

[Sumach Tan-tub.]

annexed cut is carried on. A large shallow circular tub, twelve or fifteen feet in diameter, is filled with hot water containing a little sumach, and near it is a smaller vessel containing a strong solution of sumach in water. Two men and a boy, standing on one side of the tub, then fill the bags with the sumach-solution thus: the boy takes a bag, and inserts into its mouth the stem of a funnel, the mouth of which is uppermost. One of the men then nearly fills the bag, through the funnel, with the solution, which he ladles from the smaller tub. The other man takes the bag from the funnel, and by a peculiar action of the breath fills with wind the remaining portion of the interior, and ties up the mouth with string. The air has the effect of distending the bag until quite free

from wrinkles, and also of causing it to float in water. All the bags, after being thus filled, are thrown into the large vessel, and are kept there about three hours, occasionally stirred and moved about with a wooden instrument. The effect of this arrangement is, that the solution of sumach contained within each bag is enabled to exert its full action on the skin in an equable manner, and to penetrate entirely through the substance. The thickness of these goat-skins is so very much less than that of the hides formerly described as being tanned by oak-bark, that the tanning principle of the sumach, aided by a certain temperature in the skin and the solution, is enabled to produce its effect in a few hours. The sumach-tubs present a singular appearance when three or four dozen inflated goat-skins are floating about in the contained liquor.

Once during the process of sumaching the skins are removed from the tub and placed on a rack or perforated bench at the side; they are heaped one on another, and by their own weight press all the sumach solution through the pores. Another sumaching and another pressing complete the operation.

The bags are next removed to another building, where the seams are loosened, the bags opened, and the sediment remaining from the sumach removed from the inside: this sediment, which often consists principally of yellow sand nefariously mixed with the sumach before it leaves Sicily, is of no further use in leather-dressing, and is taken away to be used as manure. The goat-skins, after being thoroughly washed, are laid out smooth on a sloping board, and 'struck,' that is, scraped and rubbed out as smooth as possible. In this smooth state the skins are hung up in a loft, and when thoroughly dried they are said to be 'in the crust.'

The skins are then nearly ready for the process of dyeing. It is generally known that most morocco leathers present beautiful and vivid colours, and to produce these the skins have to undergo a very careful process of dyeing. The drying in the loft has had the effect of shrivelling the skins in some degree; to obviate which, and to prepare them for the reception of the dye, the skins are wetted, and 'struck out,' or smoothed again. The dye-house presents those general features which, whether the substance to be dyed be cloth or leather, are observable in such places. At Messrs. Bevington's the dye-house contains five coppers for the reception of hot-water or logwood-solution; square tanks for containing the dye; frames whereon to suspend the skins in various solutions; and other similar arrangements. As many of the ingredients used in dyeing are costly, and as the finished leather is intended to be seen only on one surface, it is customary to lay two skins in close contact before dyeing, so that the dye-liquor may not be wasted by acting on both surfaces of each. The dyeing ingredients employed, the number of immersions which the skins undergo, the changes in the solutions to which the skins are exposed, and the time employed in the various parts of the process, are points involving much practical skill, and on which we can say but little. The crimson, the scarlet, the purple, the indigo morocco-leather, all require particular modes of treatment, arising from the qualities of the dyeing ingredients used.

After the dyeing, the skins undergo two or three processes of rubbing, which seem to act somewhat on the principle of currying, by giving a softness and pliability to the leather. This is especially the case in the finishing process, by which the wrinkled appearance is given to the material. Every one knows that the coloured surface of morocco leather has the appearance of having been indented all over by an instrument sharp enough to leave permanent depressions, but not so sharp as to cut the leather. This effect is produced on the smooth goat-skin thus:—The workman lays the skin on a sloping bench, with the dyed surface uppermost, and rubs it forcibly with a ball made of some hard wood, such as box. The ball is about the size of a small lemon, and has on its surface a number of fine parallel grooves. As the ball is worked over the leather in the direction of these grooves, it leaves permanent marks thereon, and thus gives rise to the appearance which distinguishes morocco from all other kinds of leather. Nothing can exceed the beauty and flexibility of the morocco leather made from the finest goat-skins: the finishing of the grooved ball makes it very pliable, while the nature of the skin itself gives it great durability and toughness. In the morocco wareroom at the Neckinger Mills the vivid colours displayed show also that this kind of leather is susceptible of receiving a beautiful dye.

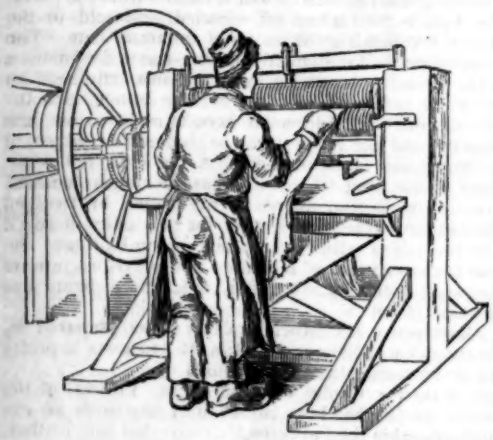
We have before stated that there is an inferior kind of morocco leather, made of sheep-skin. This, under the name of 'imitation' morocco, is largely used for inferior or economical purposes; and though it is inferior to the other kind in suppleness and durability, its superficial appearance is very nearly equal: indeed it is to this latter fact, combined with greater cheapness, that we may attribute its extensive manufacture. In the manufacture of morocco leather from sheep-skins there are not many points of difference from the analogous manufacture from goat-skins; but it will be necessary to speak briefly of the different states in which the skins come into the hands of the leather-dresser.

There are in Bermondsey about twenty or thirty manufacturers called *fellmongers*, whose business it is to bring sheep-skins into a certain state of preparation before the leather-dresser commences his operations thereon. The skins from nearly all the sheep slaughtered in London are conveyed to a skin-market in the western part of Bermondsey, and there sold by factors or salesmen, who act for the butchers, to the fellmongers. The skins are bought and sold with the wool on, and the labours of the fellmonger relate to the separation of the one from the other, and the disposal of the wool to the woolstaplers, most of whom live also in Bermondsey, and the 'pelts' or stripped skins to the leather-dressers and the parchment-makers. The trade of a fellmonger is more dirty and disagreeable than even that of a leather-dresser, on account of the mode necessary to be adopted for the separation of the wool from the pelt. These remarks, so far as the leather-dresser is concerned, apply only to sheep-skins, for the skins of the goat, the kid, the buck, the doe, and one or two other kinds of animals which have a hairy rather than a woolly covering, come into his hands before the hair has been removed; and the process of 'unhairing' is then effected.

In the manufacture of sheep-skins into 'imitation' morocco, and into roan leather, a routine of operations occurs not very different from that sketched above. Both kinds are prepared by sumach-tanning; and the preparatory and subsequent processes are for the most part similar to those necessary for goat-skin morocco. There are, however, one or two points of difference which must be noticed. The skin of the sheep, from the organization which promotes the rapid growth of wool, contains a much larger amount of grease, or oleaginous matter, than the skin of the goat; and it is essential that this be removed before the tanning principle is brought to act upon the skin. To effect this, the skins, shortly before being placed in the sumach-tan, are subjected to the action of a hydrostatic-press, which by a pressure of many tons forces out the extra-

neous matters from the pores of the skin. The kind of leather called 'roan' does not present the wrinkled or grained appearance of morocco leather, a difference which results from the different mode of finishing after the dyeing; the grooved balls not being used for the roan leathers.

The kind of sheep-skin leather called 'skiver,' used for common bookbinding, hat-linings, pocket-books, work-box covers, and other cheap purposes, deserves notice for a process the most remarkable, in a mechanical point of view, which the Neckinger establishment presents; we mean the 'splitting' of a skin into two thinner skins. Thin as a sheep-skin is, and supple when wetted, it might be thought that the operation of splitting or slicing it into halves, without cutting holes in either, would be an impossible task; yet this is effected with the utmost accuracy. We have seen, at a large tannery in Bermondsey, a machine for splitting hides; but the small thickness of a sheep-skin requires peculiar arrangements for effecting a similar bisection. The object aimed at in this operation is twofold, viz., to obtain a thin kind of leather for some purposes for which a sheep-skin in the natural state would be too thick, and to obtain a quality of leather which could be sold at a lower price than that made from whole skin. The principle of the machine is this:—Two rollers, ranged horizontally in a frame, are made to rotate in opposite directions, the vacancy between them being only just sufficient to admit a soft wetted sheep-skin or pelt. The rotation of the rollers causes the skins to be drawn slowly between them; but it cannot do so without encountering the blade of a very sharp knife, which has a reciprocating horizontal motion, in such a position as to cut the skin into two thicknesses as it passes the knife, one-half passing over, and the other under the blade. A most



[Leather-splitting Machine.]

ingenious contrivance is adopted for yielding to any inequalities which may occur in the skin. One of the rollers is made in several pieces, so adjusted that in passing over any thickened portions of the skin the common aperture between the rollers is widened at that part. It is one of the consequences of the construction of the machine, that one of the semi-thicknesses or sections must be equable and level in every part, while any inequalities which might have existed in the original skin will be thrown into the other section. Either section, the 'grain' side or the 'flesh' side, may have this equable thickness given to it, according to the mode in which the skin is adjusted on the rollers; and the two portions may have various ratios given to their thicknesses, according to the position of the vibrating knife opposite the opening between the rollers. These machines, of which there are three or four in the Neckinger factory, were patented by the proprietors several years ago, and exhibit very beautiful mechanical arrangements. A sheep-skin of the usual size occupies about two minutes in splitting, during which time the knife makes from two to three thousand vibratory motions to and fro, cutting a minute portion of the skin at each movement. The preceding cut represents a sheep-skin undergoing the process of splitting in one of these machines.

As the thin 'skivers' are more readily acted on by the sumach-tan than the thicker goat-skins, they are not sewn up into bags like the latter, but are immersed in the sumach-tub in an open state, and are tanned in a very short space of time. The subsequent operations require less delicacy than in the preparation of morocco leather, and do not call for much remark.

Among the varieties of leather tanned with sumach is the 'enamelled leather,' now occasionally employed for ladies' shoes. This is made of seal-skin or thin calf-skin, coated, after tanning, with a peculiar kind of varnish or japan capable of yielding a brilliant gloss.

3. *Leather prepared with Alum.*—The technical name of 'tawing' is frequently applied to the general routine of operations whereby alumed leather is produced. This variety of leather is in many cases left white or undyed, and has a peculiar softness when finished. The skins which undergo the process of 'tawing' are those of the kid, the sheep, and the lamb; the first-named of which yield the well-known 'kid leather' of which gloves and ladies' shoes are made; while the white leather made from sheep-skin is used for lining shoes and other inferior purposes. The cheap kid gloves which are displayed in the shop-window of the hosier are generally made from lamb-skin, and may be considered as an imitation kid.

The kid skins which form the staple of this branch of the manufacture are brought from Italy: they are very small in size, and have the hair on. The first operation to which they are subjected is steeping for the space of three days, by which they become soaked and softened: they are then 'broken' on the flesh side, a process resembling that to which goat-skins are subjected: the skin is laid on a beam or convex bench, with the flesh side uppermost, and is then scraped: this seems to facilitate the action of the lime in the next process. After the 'breaking,' the kid-skin is immersed in lime-water in a pit for about fourteen or sixteen days, by which the hair becomes in some measure loosened from the pelt; and at the end of this period the operation of 'unhairing' is effected in the same manner as for goat-skins. In a few days after this process the skin is 'fleshed,' to procure a clean surface on the inner side, and after this the pores are opened and the lime 'killed' (to use a technical term). This opening of the pores is effected not by the alkaline solution called the 'pure,' as in goat-skin dressing, but by steeping the skin in a solution or 'drench' of bran and water. When this is effected, the skin is laid down on the 'beam' with the grain-side uppermost, and 'struck,' or forcibly worked with a knife, whereby the impurities are worked out from within the pores. After a further steeping for a day or two in bran and water, the skin is in a state to undergo that process which constitutes the principal difference between sumached leather and alumed leather. Instead of being sewn up into bags filled with sumach liquor, and immersed in a tub of hot water, the skins are put into a kind of barrel called a 'roundabout:' this barrel has a door or opening in

one part of its curved surface, through which the skins are placed; and when the water and ingredients are added, the door is closed, and the barrel made to rotate rapidly. The effect of the rotation is to cause the impregnated liquor to act intimately on every part of the skin. The substances placed in the barrel to act on this skin are, for the commoner kinds of leather, alum and salt; and for the better kinds, alum, salt, flour, and yolk of eggs: these latter ingredients are for the most part absorbed into the substance of the finer kid leathers, and seem to have the effect of imparting that beautiful softness and plumpness which such leather presents. About twelve pounds of alum and a little more of common salt are sufficient for about two hundred skins. Sometimes the skins are not put into the 'roundabout,' but are merely steeped in the solution in an open tub: whether the one or the other plan be adopted, however, a period of five minutes is sufficient to produce the effect. In that part of the 'tawing' process wherein eggs are employed, the eggs are broken, in the proportion of one to each skin, and the yolks only are mixed with water and a little meal in a tub: the skins are then introduced, and are trampled by the naked feet of a man until the egg has been thoroughly imbibed. The eggs employed for this process are imported from France: sixty or seventy thousand are purchased for the Neckinger factory every spring, and are preserved in lime-water till wanted, a mode by which they may be kept perfectly sweet for two years.

The tawed skins, after being hung up in a loft to dry, are stretched out, smoothed, and softened, by the process of 'staking,' represented in the annexed cut.

['Staking' tawed leather.]

In one of the upper rooms of the establishment are a number of wooden blocks, having at the upper end a steel instrument, shaped somewhat like a cheese-cutter, but not having a very sharp edge. Over the semicircular edge of this instrument each skin is drawn very forcibly, the workman holding it in both hands, and scraping the surface in various directions on the steel edge. This has the effect of stretching out the skin to its full extent, and of removing all the rigidity and stiffness which it had acquired in the previous processes. This is, indeed, one of the many processes of violent rubbing, scraping, or friction to which every kind of leather is more or less subject in the progress of manufacture; but in this instance the rubbing is effected when the leather is nearly in a dry state.

For the production of 'imitation' kid leathers the skin of lambs is employed; and for this purpose lamb-skins are imported from the shores of the Mediterranean. They are imported with the wool yet on them, and as this wool is valuable, the leather-manufacturer carefully removes this before the operations on the pelt commence. The wool is of a quality which would be greatly injured by the contact of lime; and therefore a kind of natural fermentation is brought about as a means of loosening the wool from the pelt. At the Neckinger establishment, one of the buildings presents, on the ground-floor, a flight of stone steps leading down to a range of subterranean vaults, or close-rooms, into which the lamb-skins are introduced, in a wet state, after having been steeped in water, 'broken' on the flesh side, and drained. The temperature of these rooms is nearly the same all the year round, a result obtained by having them excluded as much as possible from the variations of external temperature; and the result is that the skins undergo a kind of putrefactive or fermenting process, by which the wool becomes loosened from the pelt. During this chemical change, ammonia is evolved in great abundance: the odour is strong and disagreeable; a lighted candle, if introduced, would be instantly extinguished, and injurious effects would be experienced by a person remaining long in one of the rooms. Each room is about ten feet square, and is provided with rails and bars whereon to hang the lamb-skins. The doors from all the rooms open into one common passage or vault, and are kept close except when the skins are inspected. It is a point of much nicety to determine when the fermentation has proceeded to such an extent as to loosen the wool from the pelt; for if it be allowed to proceed beyond that stage, the pelt itself would become injured.

When the fermentation is completed, generally in about five days, the skins are removed to a beam and there 'slimed,' that is, scraped on the flesh side to remove a slimy substance which exudes from the pores. The wool is then taken off, cleaned, and sold to the hatters for making the bodies of common hats. The stripped pelts are steeped in lime-water for about a week, to 'kill' the grease, and are next 'fleshed' on the beam. After being placed in a 'drench,' or solution of sour bran, for some days, to remove the lime and open the pores, the skins are alumed and subjected to nearly the same processes as the true kid-skins. These Mediterranean lamb-skins do not in general measure more than about twenty inches by twelve; and each one furnishes leather for two pairs of small gloves. These kinds of leather generally leave the leather-dresser in a white state; but undergo a process of dyeing, softening, 'striking,' &c., before being cut up into gloves.

There are a few other kinds of skins prepared by aluming, but the general routine of processes is pretty much the same as herein described.

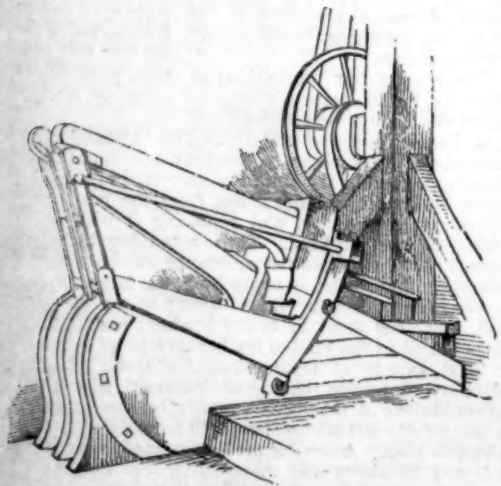
4. *Leather prepared with Oil.*—The 'killing' of the animal quality of skins (if we may use such an expression), whereby the skins are converted into leather, seems to consist in forcing out from the pores some albuminous substance, and replacing it with a substance of another kind. Thus in tanning hides, the tannin penetrates into the substance of the skin and combines therewith; in sumaching, the larger portion of the sumach does the same thing; so do the alum, salt, egg, and meal in tawed leather; and lastly, so does the oil in the kind of leather now to be noticed.

That variety of leather called chamois, chammy, shammy, shammoy, shamoy, or shamoyed, which is the characteristic of oil-leathers generally, was originally a beautifully soft leather prepared from the skin of the chamois goat. A similar mode of manufacture is now adopted for sheep and other skins, but the name of chamois, modified in the spelling to a strange degree, is still applied to the leather produced. Mr. Aikin,

in one of his lectures before the Society of Arts, made the following statement in reference to shamoyed leather:—"Till a few years ago, there was an immense quantity of the skins of sheep, goats, and deer shamoyed in England. Breeches of this article, either white or dyed, were commonly worn by persons whose occupations or amusements led them to be much on horseback: They were worn by most of the cavalry of Europe; and the English shamoyed leather, being of extraordinary good quality, was employed in clothing not only our troops, but the cavalry of Prussia, Austria, and most of the other German states. In the campaigns in Spain during the last war, it was discovered by the British commander that the health of the horse-soldiers was seriously affected in wet weather by the leather that they wore, which, fitting close to the skin and being long in drying, chilled the men and rendered them liable to rheumatism and other diseases. Woollen cloth was accordingly substituted; and the example having been followed by Austria and Prussia, this change has occasioned a great decline in that branch of the English leather-trade."

The shamoy leather, whether of the superior kind just alluded to, or of that more humble description known as 'wash-leather,' is prepared nearly as follows:—The deer and sheep skins undergo the earlier stages of preparation nearly in the same manner as for other kinds of leather, such as washing, liming, beaming, &c. It must be remarked, however, that the inferior or thinner kinds are generally made of split skins, the more irregular of the two halves, generally the flesh side, being used for this purpose; the other half being alumed or tawed for 'skiver' leather. In general, oil-leathers have the 'grain' surface of the skin entirely removed before any oil is applied; as this removal not only affords a much softer surface, but greatly increases the extensibility of the leather, which still remains sufficiently strong and elastic for the purposes to which it is applied. This 'frizing,' or removal of the grain, is effected either by the edge of a round knife or a rubber of pumice-stone.

The lime and other obstructions to the porosity of the skin having been removed by steeping in sour bran and water, the skins are wrung or pressed as dry as possible, and are then ready for the reception of the oil. This is forced into the pores in a curious manner. In one of the buildings of Messrs. Bevington's establishment are two pairs of 'fulling-stocks,' such as are represented in the preceding cut, and somewhat resembling those used in the woollen manufacture. Each pair consists of two stocks, which may be likened to heavy wooden hammers; the head, covered with copper, being attached to a long beam or handle lying in an inclined position. Near the lower end of each a wheel revolves, by which each hammer is in turn lifted up and let fall again, through a space of about a foot. This they do in a kind of trough, so that any substances which may be placed in the bottom of the trough receive a blow from each stock every time it descends. The upper or handle end of each stock is so adjusted as to work on a pivot or axis.



[Oil-Leather Fulling-Stocks.]

Into the trough connected with these fulling-stocks the leather is placed; the stocks are set in action; and the leather is beaten alternately by one and the other until rendered as dry as possible. Cod-oil is then poured on the skins in the fulling-machine, and this is forcibly driven into the pores of the skins by another lengthened beating with the stocks. The trough is so formed in an arc or curve, that as the stocks beat the skins, the latter become turned gradually over and over, whereby every part of each is exposed to the operation. When the oil is beaten in, the skins are removed, shaken out flat, hung out in the air to dry, again put into the fulling-mill, supplied with fresh oil, and subjected to a renewed fulling with the stocks. Again and again is this repeated; oil being poured on the skins in small quantity, and then beaten into the pores by means of the stocks. This occurs as many as eight or nine times, oil being added each time, and well beaten in, until two or three gallons of oil have been imbibed by one hundred skins.

When the oil is thus forced into the heart of the skins, they are placed in large tubs, where they undergo a kind of fermenting process, by which a more intimate action of the oil upon the fibres seems to be induced. These tubs are placed in one of the lower buildings near the fulling-stocks; and from them the skins, now converted into shamoy leather, are removed, to be immersed in a weak solution of potash. This latter process is intended to remove whatever excess of oil may have remained in the leather. After being hung up to dry in the open air, the leather is finished.

Thus have we endeavoured to give an outline of a manufacture which is supposed to rank fourth in the kingdom, being only excelled in importance by those of cotton, wool, and iron. The quantity of hides and skins converted into leather yearly in England is almost incredibly large; at Messrs. Bevington's establishment alone there are about two hundred and fifty thousand skins annually converted into leather by the aluming or tawing process, two hundred and twenty thousand by the sumach-tanning process, as well as a small number by the oil-dressing process. This circumstance marks the importance and extent of the leather-manufacture, respecting which Dr. Campbell, in his 'Political State of Great Britain,' makes the following striking remark:—"If we look abroad on the instruments of husbandry, on the implements used in most mechanic trades, on the structure of a multitude of engines and machines; or if we contemplate at home the necessary parts of our clothing—shoes, boots, and gloves—or the furniture of our houses, the books on our shelves, the harness of our horses, and even the substance of our carriages,—what do we see but instances of human industry exerted upon leather? What an aptitude has this single material in a variety of circumstances for the relief of our necessities, and supplying conveniences in every state and stage of life? Without it, or even without it in the plenty we have it, to what difficulties should we be exposed!"